DOCUMENT RESUME

ED 322 492 CS 010 196

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TITLE Improving Content Area Reading Using Instructional Graphics. Technical Report No. 508.
INSTITUTION Bolt, Beranek and Newman, Inc., Cambridge, Mass.; Illinois Univ., Urbana. Center for the Study of Reading.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE Aug 90
CONTRACT G0087-C1001-90
NOTE 37p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Content Area Reading; Grade 4; Grade 5; *Graphs; Intermediate Grades; *Learning Strategies; *Reading Comprehension; *Reading Instruction; *Social Studies; Teaching Methods; Textbooks
IDENTIFIERS Expository Text; Knowledge Acquisition; *Organizational Frames

ABSTRACT

A study investigated the effectiveness of using a particular type of instructional graphic, a "frame," on fourth and fifth graders' ability to learn from reading their social studies textbooks. Six fourth- and six fifth-grade teachers taught social studies using either frames or the instruction suggested in the teacher's edition of the regular classroom social studies textbook. The treatment was repeated in four rounds (replications) during the school year. The major result from the combined analysis of the four rounds was that for fifth graders but not necessarily for fourth graders, framing was a more effective instructional technique than was the instruction suggested in the teacher's edition. (Four figures and 8 tables of data are included, and 32 references are attached.) (Author/SR)

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ED322492

# CENTER FOR THE STUDY OF READING

Technical Report No. 508

## IMPROVING CONTENT AREA READING USING INSTRUCTIONAL GRAPHICS

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CS010196

The work upon which this publication was based was supported in part by the Office of Educational Research and Improvement under Cooperative Agreement No. G0087-C1001-90 with the Reading Research and Education Center. The publication does not necessarily reflect the views of the agency supporting the research.

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## Abstract

The purpose of this study was to investigate the effectiveness of using a particular type of instructional graphic, a "frame," on fourth and fifth graders' ability to learn from reading their social studies textbooks. Six fourth- and six fifth-grade teachers taught social studies using either frames or the instruction suggested in the teacher's edition of the regular classroom social studies textbook. The treatment was repeated in four rounds (replications) during the school year. The major result from the combined analysis of the four rounds is that for fifth graders but not necessarily for fourth graders, framing was a more effective instructional technique than was the instruction suggested in the teacher's edition.

# IMPROVING CONTENT AREA READING USING INSTRUCTIONAL GRAPHICS

Students have difficulty understanding and learning from informational text. A recent summary of findings from the National Assessment of Educational Progress (Applebee, Langer, & Mullis, 1989) includes this dismal conclusion about the reading ability of American students:

> The failure of 61 percent of the 17-year-olds to demonstrate the ability to find, understand, summarize, and explain relatively complicated information, including material about topics they study in school, suggests that most students leaving secondary school do not have the comprehension skills often needed in the worlds of higher education, business, or government. (p. 22)

Why do many students have trouble learning from informational text? There are many contributing and interacting factors, including motivational, situational, and cognitive. The focus in this report is on cognitive factors.

Cognitive theories of reading are in basic agreement about what is involved in learning from text (see, for example, Anderson & Pearson, 1984; Prawat, 1989; Rumelhart & Ortony, 1977; van Dijk & Kintsch, 1983). Mayer (1984, 1989) presents an oversimplified, but nonetheless useful, conceptualization of the cognitive processes involved in meaningful learning from text. According to Mayer, meaningful learning depends on three basic processes--selecting, organizing, and integrating information.

The first process, selecting, involves paying attention to the information in the text and, in particular, focusing attention on information that is relevant to the goals or task demands of the learning situation. The second process, organizing, involves arranging the units of selected information into a coherent mental structure. Mayer (1984) refers to this step as "building internal connections," or constructing logical relationships among ideas in the text. The third process, integrating, involves connecting the coherently organized information to existing cognitive structures. This process is also referred to as "building external connections" because it entails linking information from the text to information external to the text (but internal to the reader) (Mayer, 1984).

The more elaborate and rich the internal and external connections among units of information, the more available and accessible the information is for later use (Prawat, 1989). Availability and accessibility of knowledge are hallmarks of meaningful learning.

Expert, or skilled, readers are adept at all three basic cognitive processes, but novice (younger or poorer) readers are not. Among the readers who appear to have difficulty with these processes when it comes to learning from informational text are children in the middle grades (4 through 9). It is in these grades that informational text, in the form of content area textbooks, first becomes a significant element in classroom instruction and learning. From about fourth grade on, textbooks play an increasingly important role in learning in the content areas (Tyson-Bernstein, 1988).

Unfortunately, research suggests that middle-grade children have difficulty in selecting, organizing, and integrating information from text. In this report, we focus on research related to the first two processes--selecting and organizing information--in middle-grade children.

One index of the ability to select information is the ability to summarize. Several researchers have shown that children in the middle grades have trouble writing summaries of informational text (Brown & Day, 1983; Taylor, 1986; Winograd, 1984). These children may have difficulty summarizing because they have trouble selecting or identifying important information in informational text. The Taylor (1986)

and Winograd (1984) studies directly support this hypothesis, because in them, ability to identify important information was significantly related to ability to summarize text.

One way of organizing information from the text (or in Mayer's [1984] terms forming "internal connections") is simply to use the author's organization, or top-level text structure. Several studies have investigated the effect of readers' awareness of text structure on their ability to recall informational text (McGee, 1982; Meyer, Brandt, & Bluth, 1980; Taylor, 1980, 1985). In these studies, awareness of text structure was indexed by the readers' use of the author's top-level text structure in organizing their own recall protocols. Meyer, Brandt, & Bluth (1980) found that skilled ninth-grade readers tended to use the top-level text structure in organizing their free recalls, while readers with low comprehension skills did not. Furthermore, readers who employed the strategy of using the text's top-level structure recalled more information than those who did not.

Taylor (1980) found the same effect for younger readers. Sixth-grade good readers recalled more from short informational passages after two days than did sixth-grade poor readers or fourth-grade good readers. This difference in recall appeared to be related to the sixth-grade good readers' greater use of text structure: More sixth-grade good readers organized their delayed recalls according to the higher order text structure than did sixth-grade poor readers or fourth-grade good readers. Also, both good and poor readers who organized their recalls according to the higher order text structure recalled more than readers who did not.

Similarly, McGee (1982) found that fifth-grade good readers used the author's text structure more and recalled more total and superordinate idea units than did fifth-grade poor readers or third-grade good readers. Finally, in a study that examined the ability of sixth-grade and college students to summarize passages from a social studies textbook, Taylor (1985) found that compared to college students, sixth graders had difficulty understanding important ideas and/or including them in either oral or written summaries. The Meyer, Brandt, and Bluth (1980), Taylor (1980, 1985), and McGee (1982) studies suggest that age and reading ability are highly correlated with recall of informational material. This relationship may result from skilled readers' greater awareness and use of the author's higher order text structure, which enables them to form a coherent organization of the text information.

Because ability to select and organize information is related to learning, it follows that instruction that fosters selection and organization should enhance learning from text. Indeed, several techniques for helping students select and organize information from text have been developed and researched. One promising technique is the use of "instructional graphics" (Holley & Dansereau, 1984) to convey verbal information in a spatial array. Instructional graphics are known by a number of names, including structured overviews, graphic organizers, maps, knowledge maps, networks, schematizations, and flow charts. In all of these techniques, words or phrases are connected with named or unnamed links that convey the structure or organization of ideas.

Several studies have investigated the effect of instructional graphics on middle-grade children's learning from reading informational text. For example, Boothby and Alvermann (1984) trained fourth graders to use instructional graphics to help them remember what they read from their social studies textbooks. Students in the graphics treatment filled out partially completed experimenter-prepared instructional graphics that depicted the top-level structure of passages from the students' regular social studies textbooks. Compared to a control group, the graphics-trained group recalled a greater total number of idea units from a target passage both immediately and after a 48-hour delay. The graphics-trained group also recalled more "main ideas," although the difference was not statistically significant.

In a study by Armbruster, Anderson, and Ostertag (1987), fifth graders were taught a problem/solution top-level text structure using instructional graphics. The instruction involved teaching students to recognize the problem/solution structure in their American history textbooks, to record notes on a graphic representation of the structure, and then to write a summary from the graphic. As measured by responses to a main-idea essay question and by written summaries of two passages, students' ability

to abstract the top-level structure of problem/solution text read independently was improved by the graphics-based structure training.

Berkowitz (1986) compared conditions in which sixth graders either constructed their own main idea/detail graphics or studied supplied graphics that accompanied social studies textbook passages. Students who became proficient at constructing their own graphics scored significantly higher on immediate and delayed free recall tests than did control group students who were expert at answering questions. The finding of no effects for the supplied-graphics procedure suggests the importance of active participation of readers in constructing a graphic representing the top-level structure of text.

In summary, recent research indicates that instructional graphics can help middle-grade students learn from reading informational text. The effectiveness of instructional graphics is probably due to their role in helping students select and organize information in text. Apparently, involvement of readers in producing the graphics is an important factor in the success of this technique.

The purpose of the study described in this report was to investigate the effectiveness of a particular type of instructional graphic, called a frame, on fourth and fifth graders' ability to learn from reading social studies textbooks. A frame is a visual representation of the organization of important ideas in informational text. Frames are intended to help readers with at least two of the basic processes involved in learning from reading--selecting and organizing information from the text. That is, frames should help readers focus attention on important text information and perceive the organization of that information. (For further information on frames, see Armbruster & Anderson, 1984a & 1984b; Armbruster & Anderson, 1985; Armbruster, Anderson, & Ostertag, 1987, 1989.)

The study is part of a larger collaborative research project called the Framing Project. The Framing Project began in the mid-1980's as a result of the concern of the reading coordinator of a school district in a small city in Illinois about improving content area reading in her district. The reading coordinator had heard about frames and wished to encourage the middle-grade teachers in the district to use frames in their social studies instruction. In this way, the reading coordinator hoped to improve both the teachers' instruction and the students' ability to learn from reading content area textbooks.

The reading coordinator approached the first two authors about her plan. An agreement was reached whereby the authors would provide inservice training, consulting, and help in the preparation of materials in exchange for the cooperation of a cadre of teachers and their students in research involving frames. The idea was that teachers would first use frames and instructional methods designed by the researchers; gradually, teachers would assume responsibility for generating frames and deciding on appropriate instruction using the frames. The study described in this report was conducted during the 1987-88 school year, the fourth year of the Framing Project.

## Method

The study involved four replications, or rounds, in which instruction using frames to supplement the textbook was compared to instruction provided in the teacher's edition of the textbook. Our hypothesis was that instruction using frames would produce greater learning than would the instruction from the teacher's edition, as measured by teacher-made tests. After Round 1, a modification was made in the research design; the modification was maintained throughout the next three rounds. Therefore, the method for Round 1 will be discussed separately from the method for Rounds 2-4.

## Round 1

### Subjects

The subjects were 365 middle-grade children--164 fourth graders and 201 fifth graders in the regular classrooms of 6 fourth- and 6 fifth-grade teachers in 10 elementary schools in the single school district of a small midwestern city. Some of the teachers had "team teaching" arrangements, which meant that they taught social studies to more than one class.

### Materials

**Texts.** Material from the regular classroom textbook constituted the texts. The district was using the 1985 edition of the social studies program published by Harcourt Brace Jovanovich. The fourth-grade textbook was *States and Regions* (1985); the fifth grade, *The United States: Its History and Neighbors* (1985). The textbooks for these two grade levels represent quite different disciplines within social studies. The fourth-grade textbook was basically geography with some history; the fifth-grade textbook was history only. The target text chapters were selected by the teachers. As a group, the teachers at each grade level decided what content they anticipated being ready to teach within the rather loose time parameters of the research project. The fourth-grade teachers chose three separate chapters for Round 1; the fifth-grade teachers chose three sections within a single chapter. Information about the titles and length of the target texts for this round is presented in Table 1.

**[Insert Table 1 about here.]**

**Frames.** In agreement with the goals of the Framing Project, frames for Round 1 were prepared by the first author. The procedure for constructing frames was as follows. First, the target text was carefully read. Next, the author's top-level text structure was identified, using textual cues such as headings, boldfaced words, and graphics. Finally, the top-level structure was represented graphically.

The process of constructing frames can best be explained with specific examples. The first example is from the fourth-grade chapter on rivers. In the first part of the chapter is a 350-word section titled "How Rivers are Formed." The section describes the process of river formation as a series of eight steps. Several vocabulary words are introduced in conjunction with the steps, such as *source* and *tributary*. The eight steps are depicted as a flow diagram, as shown in Figure 1.

**[Insert Figure 1 about here.]**

The second example is from the fifth-grade lesson on physical maps. In this 900-word section, three types of maps are discussed--relief, elevation, and physical. For each type of map, information is presented about using the map and reading the map. This information was represented as a table or matrix, as shown in Figure 2. (Note that a column for "Examples" was also included so that students could record page numbers containing examples of each type of map. This information was not given in the lesson but was included so students would have an opportunity to apply information from the text.)

**[Insert Figure 2 about here.]**

For the fourth grade, each chapter had several frames. Only one frame was prepared for each part of the shorter fifth-grade materials. Page numbers at the top of the frames indicated where the relevant information could be found in the chapter. "Blank" frames such as those in Figures 1 and 2, without the answers filled in, were then reproduced for distribution to students. Filled-in versions of the frames were prepared as answer keys for teachers.

**Dependent measures.** The first author prepared the immediate criterion test materials. For the fourth grade, the test for each chapter consisted of recognition (matching) and recall (short-answer) items. The matching items focused on vocabulary words and their definitions. The short-answer items tested concepts and relationships. They were worded as specifically as possible. For instance, in many cases, the number of items to be included in the response was specified, as in the following examples: "What are two examples of how rivers change the land around them?" and "What are two ways that the Rocky Mountains and the Appalachian Mountains are different?" This practice was designed to help students answer the questions as well as to facilitate scoring.

For the fourth grade, there were 8 matching items and 6 to 10 short-answer items per test, for a total of 25-29 points. For the fifth grade, the test for each chapter part consisted entirely of short-answer items. These items were similar to the fourth-grade items, in that they tested concepts and relationships and were worded as specifically as possible. There were 2 to 11 items per test, for a total of 12-16 points.

In addition, both the fourth- and fifth-grade students' most recent reading comprehension scores from the California Achievement Test (CAT) (Book 15C, 1977) were recorded.

**Materials for teachers.** Teachers were provided with the following materials: (a) copies of the frames they would need (Framing conditions only), (b) copies of an "answer key" for each frame (Framing conditions only), (c) copies of the tests, (d) written directions for each condition of the study, and (e) "Teacher Logs" on which to record their notes about the dates, times, and progress of the instruction. The reason for the logs is that the time for each treatment was not prescribed; therefore, it was necessary for the teachers to keep track of the days and times they spent on each lesson.

## Design

There were three experimental conditions. In Condition 1, "Student Framing," the students completed the frames independently after silently reading the target text. In Condition 2, "Teacher-led Framing," the teacher led a discussion about the frame as students read the chapter and recorded the frame on the chalkboard. In Condition 3, "Teacher's Edition" (or control), the teachers followed the basic recommended instruction in the teacher's edition, including workbook assignments. In a Latin square design, each teacher was assigned to teach all conditions, thus counterbalancing the experimental design (see Table 2). In this way, each teacher served as his or her own control, and all 365 students served as subjects in each of the three conditions.

**[Insert Table 2 about here.]**

## Procedure

**Condition 1, Student Framing.** Before students read the chapter, the teacher made a copy of the frame(s) on the chalkboard and led a discussion about students' prior knowledge and/or predictions about each part of the frame. The teacher recorded this prereading information in the frame. Students then silently read the chapter and filled out the frame on their own. When students had completed their individual frames, the teacher led a discussion about the frame, encouraging students to provide evidence from the text to support their ideas. The teacher recorded a final consensus frame on the chalkboard, amending the prereading version of the frame as needed. Students then made their own copies of the final frame.

**Condition 2, Teacher-led Framing.** After the prereading frame(s) had been completed as in Condition 1, the class read the text (usually orally, in a round-robin fashion). The teacher then led a discussion about the frame, encouraging students to provide evidence from the text to support their ideas. The

teacher recorded a final consensus frame on the chalkboard, amending the prereading version of the frame as needed. Students then made their own copies of the final frame.

**Condition 3, Teacher's Edition (Control).** The teacher followed the directions in the teacher's edition as a whole-class activity. The teacher's editions essentially provided some suggestions for discussion and questions. For example, the following is an excerpt from the teacher's edition for the fifth-grade chapter:

> Introduce the lesson by reviewing the reasons for the establishment of Jamestown (desire for wealth, for trade). Encourage the students to think of other reasons to start a colony. (Possible answers: desire for independence, freedom of religion)
> Discuss the Pilgrims and their difficulties in Europe.
> Ask:
> - Why were these people called Pilgrims? (They made a journey for a religious reason.)
> - Why did the Pilgrims leave England? (They could not practice their religion freely there.)
> - Why did the Pilgrims want to leave Holland? (They worried about their children losing their English ways.)
>
> (*The United States: Its History and Neighbors*, 1985, p. 135)

## Instructional Time

In the spirit of the collaborative project, teachers were allowed some freedom in implementing the condition to which they were assigned. In particular, no attempt was made to control instructional time for any of the conditions or any of the rounds; rather this was left to the discretion of the teachers. Therefore, the time for the instruction varied somewhat by teacher, content, and condition. Teachers were encouraged, however, to use the "Teacher Logs" to record the dates and times they spent in each condition. As a result of this variability, Round 1 was implemented sometime between late October and mid-December of 1987.

## Testing

For each condition, teachers administered the criterion test three days after the final day of instruction. Students were urged to study the frame (if available) as part of their preparation for the test.

## Scoring

The criterion tests were scored using answer keys. Matching items were worth 1 point each; short-answer items were worth a variable number of points. When specific numbers of responses were requested in the question, the answer was worth that number of points. For instance, the item "What are four examples of ways that people change rivers?" was worth 4 points. The point values of other questions varied according to answer possibilities. For example, the item "How does wind affect deserts?" was worth 1 point because there was only one effect given in the text. On the other hand, the item "Tell why the following people were important to the colony's survival: John Smith, John Rolfe, Pocahontas" was worth 3 points--one for each person mentioned in the question. Raw test scores were converted to percentage correct scores.

## Introduction to Rounds 2-4

Due to the large amount of data, it was not possible to analyze the results of Round 1 before designing Round 2. Therefore, modifications in the design were based on the teachers' perceptions of Round 1 and their evolving conceptions of how instruction would best proceed.

After Round 1, teachers recommended several changes for Round 2. First, they felt that the "Student Framing" condition was too difficult for students. Teachers were more comfortable with a compromise between the "Teacher-led Framing" and "Student Framing" conditions. The compromise was that students would frame in small groups, where they would receive peer support but also have substantial personal responsibility for the task. This decision was supported by suggestions in the literature that such cooperative learning structures facilitate achievement in problem-solving tasks, increase student involvement, and improve attitudes toward instruction (Johnson & Johnson, 1974; Slavin, 1980, 1983). Several studies suggest that in complex learning activities such as studying texts, the use of cooperative groups results in higher achievement and greater retention of content area information when compared with individualistic competitive structures (Johnson, Maruyama, Johnson, Nelson, & Skon, 1981; Slavin, 1980, 1983).

The teachers' second recommendation was to provide students with some additional help in completing a frame. The teachers believed that the category labels of the frames were insufficient to guide students in selecting appropriate information from the text. The agreed-upon solution was to provide students with an "information sheet" containing the "chunks" of information to be placed on the frame. The task would then be to match pieces of information from the information sheet to the appropriate part of the frame.

In order to keep the task somewhat challenging and to encourage interaction with the text, the information sheets were to be designed as follows. First, most chunks of information would be incomplete; that is, they would have missing words or phrases, indicated by blanks, that the students would supply. We believed this would ensure that students paid close attention to the individual chunks of important information. Second, the chunks would be arranged so that the presentation order on the information sheet would differ from the order of information in the frame. In this way, students would have to think carefully about where the chunks logically fit within the structure of the frame. In short, we hoped the use of both frames and information sheets would help students focus on important ideas and their interrelationships without being overwhelmed by the difficulty of the task.

The third thought the teachers had after Round 1 was that the short-answer questions were too difficult, primarily because the students were not familiar with this test-item format. Therefore, it was decided to have students practice writing answers to short-answer questions, called "writing prompts," as a part of the instruction. Also, the teachers wanted the criterion tests to include more recognition-type (matching) items.

In sum, the following changes were made after Round 1 that would apply to Rounds 2-4.

1. Eliminate "Teacher-led Framing" and "Student Framing" conditions. Substitute a "Framing" condition in which students would complete frames in small cooperative learning-type groups.

2. Provide an "information sheet" that would contain the information required by the frame.

3. Make the information on the "information sheet" incomplete and present it in an order that would not match the order of information on the frame.

4. Provide instruction and practice in writing short answers using "writing prompts."

5. Include more recognition-type items on the criterion tests.

## Materials

**Texts.** As in Round 1, the target textbook chapters were selected by the teachers at each grade level. The titles and approximate number of words in the target texts for Rounds 2-4 are presented in Table 3. The last fourth-grade chapter and all the fifth-grade chapters were divided into two parts of approximately equal length in order to accommodate the research design.

**[Insert Table 3 about here.]**

**Frames.** The first author prepared the frames for Round 2, using the same procedure described in Round 1. In keeping with the intent of the collaborative project, the teachers assumed increasing responsibility for developing the frames for Rounds 3 and 4.

The teachers prepared the frames as follows. During three days of released time from teaching, the teachers met with the reading coordinator and the researchers. They spent about two-thirds of each of the days preparing frames and tests. The fourth- and fifth-grade teachers worked in two separate groups. They first reviewed the chapter or chapter part to be framed. Then they discussed the main concepts they wished to teach. Next, they decided on the text structure underlying those concepts. Finally, they produced final frames with the requisite information filled in. Occasionally, the first author would modify a frame somewhat if she thought it could be clarified. The final frames included page numbers indicating where the relevant information could be found in the chapter. The "blank" frames were then typed and reproduced for distribution to students. Figure 3 presents an example of a filled-in (answer key) frame for Rounds 2-4. (Note that this example represents a text structure common to historical text, as described in Armbruster & Anderson [1984b].)

**[Insert Figure 3 about here.]**

**Information sheets.** Information sheets were prepared by the first author from the filled-in frames submitted by the teachers. Composed primarily of paraphrased information from the text, the "chunks" of information from each box or space on the frame were extracted. Then, for most chunks, key words or phrases (including vocabulary words, names, and places) were deleted and replaced by blanks. The order of the chunks was then scrambled, and the scrambled chunks were typed onto a single sheet. Figure 4 is an example of an information sheet to accompany a fourth-grade frame.

**[Insert Figure 4 about here.]**

**Dependent measures.** The criterion tests consisted of recognition (matching and/or multiple choice) and recall (short-answer) items. Some items were taken from the tests included in the teacher's edition of the textbooks. The teachers and first author made up the remainder of the items. The short-answer items were constructed as in Round 1.

The number of matching, multiple-choice, and short-answer items varied for content and grade. For the fourth grade, there were 30-35 total points per test, about equally divided between matching/multiple-choice and short-answer items. For the fifth grade, there were about 15 points for each chapter part, again about equally divided between matching/multiple-choice and short-answer items.

**Writing prompts.** The writing prompts were prepared by the teachers. They were simply short-answer questions that were *not* asked on the criterion tests. Examples of writing prompts were: "Why can the plains states grow so much food?" and "How did Daniel Boone help in settling the West?"

**Materials for teachers.** Materials provided to each teacher for each round included (a) copies of frames and information sheets (Framing condition only), (b) copies of the answer key for each frame (Framing condition only), (c) copies of the tests and writing prompts, (d) written directions to the teacher, and (e) "Teacher Logs" on which to record notes about the dates, times, and progress of instruction.

## Design

There were two experimental conditions for Rounds 2-4. In Condition 1, Framing, students completed the frames in small groups of three or four students of mixed ability. In Condition 2, Teacher's Edition, or control, the teachers followed the basic recommended instruction in the teacher's edition, including workbook assignments.

For each round, half of the teachers at each grade level were assigned to the Framing condition for one chapter or chapter part and to the Teacher's Edition condition for the second chapter or chapter part; the other half of the teachers were assigned to the opposite conditions. Thus, as with Round 1, each teacher served as his or her own control, and all subjects participated in both conditions.

## Procedure

**Condition 1.** The teachers distributed the frames. Before students read the chapter, the teachers elicited prior knowledge and/or predictions about the frames from the whole class. Then students were divided into groups and given the information sheets. Each group read the text pages for each frame. Then, as a group, they completed the corresponding information sheet by filling in all blanks. Next, they cut out each information chunk from the information sheet. Then, as a group, they decided where each chunk should be placed on the frame. When all groups had completed a draft frame, the teachers led a whole-class discussion about the frame. After class consensus was reached, each student glued or taped the information chunks to the frames in order to create a permanent record.

**Condition 2.** The teachers simply followed the directions in the teacher's edition as a whole-class activity.

## Instructional Time

As with Round 1, no attempt was made to control instructional time for the conditions. Round 2 was completed between January and mid-March, Round 3 between late March and early May, and Round 4 between mid-April and late May.

## Testing

As with Round 1, for each condition in each round, teachers administered the criterion test three days after the final day of instruction. Students were urged to study the frame (if available) as part of their preparation for the test.

## Scoring

The criterion tests were scored in the same way as in Round 1. The only change was that the new addition to the tests of Rounds 2-4, the multiple-choice items, were worth one point each.

## Statistical Analyses

A series of preliminary tests was performed to determine the relationship between the criterion test scores and the reading ability covariate, the CAT reading comprehension scores. In separate analyses

for the fourth- and fifth-grade students, the linear, quadratic and cubic "best fitting/least squares" curves (Wilkinson, 1987) were computed and tested for significance. The residuals from the respective, best fitting curves were used in the ensuing analyses for the fourth- and fifth-grade students.

These residuals were analyzed within the flexible logical and computational framework afforded by the general linear model, following the procedures of Cohen and Cohen (1983) and Pedhazur (1982). The variability of the entire set of residual criterion test scores was analyzed to determine its sources. All possible main effects--treatment conditions, teachers, grades, and their interactions--were used to account for the variability. The between-subjects factor (Grades 4 and 5) was evaluated in terms of its contribution in explaining between-subjects variance while the remaining within-subjects factors were evaluated in terms of their contribution in explaining within-subjects variance. In each case, the error variance was the final residual after all systematic sources of variance had been removed, either by entry into the equation or off-line partitioning of variance. This amounts to a pooled estimate of various theoretically possible sources of error.

Since Round 1 was slightly different from the other three rounds in that there were three treatment conditions compared to only two in Rounds 2, 3, and 4, a separate analysis was used with Round 1 data. The results of Round 1 showed that the two Framing conditions were essentially equal (see the following Results section); therefore, they were recoded in the data set as a single Framing treatment. This recoding enabled Round 1 data to be analyzed with those from the other three rounds. The effects of treatment conditions, teachers, grades, rounds, and all possible interactions were investigated.

## Results

The preliminary tests of nonlinearity between the criterion test scores and the reading ability covariate showed that the relationship was essentially linear for the fourth graders and quadratic for the fifth graders. Because using a straightforward covariance approach (which assumes a linear relationship) to account for the total variability of all students was not the best strategy for the fifth graders, another approach was used. Specifically, a residual score for each student in his or her respective grade group was computed relative to the best fitting curve (a least squares regression line for the fourth graders and a quadratic function for the fifth graders), and used in the ensuing analyses (including the analyses for "all rounds," i.e., Rounds 1-4). The interactions between the best fitting curves and the treatment conditions for each grade group were tested and not found to be statistically significant for either grade group. In other words, there was no significant Ability x Treatment interaction.

Please note that all means reported in this section are actual (not adjusted) test scores (percentage correct) from specified cells within the design. The reported scores were not adjusted by the covariate (reading ability) because most of the comparisons involving the treatment conditions are within-subjects analyses; therefore, the adjustment would make no difference. In comparisons across teachers and rounds, however, many additional sources of variance are operating and the actual means are less meaningful. The standard deviations in all cases below are inflated in that many known sources of variance (known and unknown) are represented in them.

## Round 1

The results of Round 1 conditions show that the effect due to reading ability was very large and accounted for a substantial percentage (32%) of the total variability. The effects associated with the treatment conditions (Student Framing vs. Teacher-led Framing vs. Teacher's Edition) were also statistically significant, $F(2,862)=8.0$, $MSe=331.2$, $p<0.001$. Bonferroni multiple comparison techniques (Wilkinson, 1987) indicated that the Student Framing condition ($M=57.1$, $sd=25.3$) was not different from the Teacher-led Framing condition ($M=57.1$, $sd=23.6$). However, both Student-Framing and Teacher-led Framing conditions were significantly higher than the Teacher's Edition condition

($M = 51.5$, $sd = 23.6$) [$F(1,863) = 10.9$, $MSe = 328.0$, $p < .001$; and $F(1,863) = 13.5$, $MSe = 328.0$, $p < .001$, respectively].

In addition, the amount of variability accounted for by the fourth-grade teachers was significant [$F(5,862) = 5.8$, $MSe = 332.0$, $p < .001$]; the variability due to the fifth-grade teachers was only marginally significant [$F(5,862) = 2.1$, $MSe = 332.0$, $p = 0.06$]. There were also significant interactions between the treatment conditions and the individual teachers in the fifth grade [$F(2,862) = 14.3$, $MSe = 332.0$, $p < 0.001$], but not the fourth grade. (See Table 4 for the means and standard deviations.) Table 4 shows that four of the six teachers showed higher means when the Framing conditions were used and two showed higher means when the Teacher's Edition was used. The interaction between the experimental conditions and grades was not significant.

**[Insert Table 4 about here.]**

## All Rounds

When the data from all four rounds were analyzed the effect due to reading ability was very large and accounted for a substantial percentage (36%) of the total variability. The effect due to treatment conditions was also statistically significant, $F(1,2763) = 22.7$, $MSe = 296.5$, $p < .0001$, with students in the Framing condition ($M = 56.9$, $sd = 23.7$) scoring higher than students in the Teacher's Edition condition ($M = 54.2$, $sd = 23.4$).

The results also showed a statistically significant main effect for both fourth- and fifth-grade teachers [$F(5,2763) = 6.2$, $MSe = 296.5$, $p < .001$; $F(5,2763) = 11.9$, $MSe = 296.5$, $p < .001$, respectively]. Table 5 presents the means and standard deviations for both grade levels across all rounds. In addition, there was a statistically significant main effect for Rounds [$F(3,2763) = 3.6$, $MSe = 296.5$, $p < .025$]. The means and standard deviations for the four rounds were as follows: Round 1: $M = 55.3$, $sd = 24.3$; Round 2: $M = 54.2$, $sd = 22.2$; Round 3: $M = 56.5$, $sd = 25.0$; Round 4: $M = 57.0$, $sd = 22.5$.

**[Insert Table 5 about here.]**

Three of the interactions involving the treatment conditions were significant. The most important one is the Condition by Grade interaction [$F(1,2763) = 13.6$, $MSe = 296.5$, $p < .001$]. Although there were no differences between treatment conditions for the fourth grade, there were at the fifth grade. For the fourth grade, the means and standard deviations were: Teacher's Edition, $M = 62.5$, $sd = 21.5$; Framing, $M = 62.6$, $sd = 20.6$. For the fifth grade, the Framing condition was significantly higher than the Teacher's Edition condition ($M = 51.9$, $sd = 25.0$; $M = 46.9$, $sd = 22.6$, respectively).

The Condition by Teachers (Grade 5) interaction was also significant [$F(5,2763) = 5.7$, $MSe = 296.5$, $p < .001$]. The interaction was due to the fact that framing was more effective for some fifth-grade teachers than for others. See Table 6 for the means and standard deviations of the six teachers for each of the two conditions. Note that even though there is an interaction between the six teachers and the treatment conditions, the mean for the Framing condition is higher than that for the Teacher's Edition for all six teachers.

**[Insert Table 6 about here.]**

There were two significant triple interactions: Condition by Round by Teachers (Grade 4) [$F(15,2763) = 6.4$, $MSe = 296.5$, $p < .001$], and Condition by Round by Teachers (Grade 5) [$F(15,2763) = 14.0$, $MSe = 296.5$, $p < .001$]. The means and standard deviations that represent these interactions are shown in Tables 7 and 8.

To help portray these interactions we analyzed how the Framing and Teacher's Edition conditions fared relative to each other for the fourth- and fifth-grade teachers by simply comparing the magnitude of the means in each replication. Recall that each teacher engaged in four replications (one for each round of the experiment) of the Framing vs. the Teacher's Edition conditions. Thus, for both the fourth- and fifth-grade teachers, there were 24 replications (4 replications x 6 teachers).

A summary of these observations for fourth-grade teachers showed that of the 24 replications, 14 favored the Framing condition and 10 favored the Teacher's Edition condition. A summary of the 24 replications for the fifth-grade teachers showed that 17 comparisons favored the Framing condition and seven favored the Teacher's Edition condition.

**[Insert Table 7 and 8 about here.]**

## Discussion

The results for Round 1 indicate that framing is an effective technique for helping both fourth and fifth graders learn from reading their social studies textbooks. Students in the two framing conditions (Student and Teacher-led) scored about 11% higher on tests consisting of recognition and recall items than did students in Teacher's Edition condition. The finding of no difference between the two Framing conditions suggests that framing is a rather flexible technique that can be used either as a focus for classroom discussion or as a study guide for independent seatwork. (Interestingly, this finding did not match the teachers' perceptions. Recall that the teachers believed the Student Framing condition was too difficult for most students.)

The results of the combined analysis of all four rounds also supported the effectiveness of the framing technique. However, the significant Condition by Grade interaction showed that framing was more successful for fifth graders than fourth graders. Fifth graders who participated in the Framing conditions scored about 11% higher on recognition and recall tests than when they participated in the Teacher's Edition condition. (Note that this percentage increase is the same as it was for Round 1.)

This brings us to the question of why framing is more effective than the discussion and questioning practices recommended by the teacher's editions. A number of possibilities exist. Our preferred explanation, of course, is based on the theoretical rationale for the study. We hypothesized that frames would help readers with at least two of the basic cognitive processes involved in learning from reading--selecting and organizing information from text.

First, framing may help students *select* important information for further cognitive processing. In the introduction, we discussed the research finding that children in the middle grades have trouble writing summaries of informational text, probably because they are unable to select or identify important information. Because frames depict the most important concepts in a text, students who use frames do not have to select or identify important information on their own.

Second, framing may help students *organize* information into a coherent mental structure. Because frames show the logical relationships among ideas in the text (for example, the temporal relationships in Figure 1 and the comparison/contrast relationships implied in the matrix structure of Figure 2), they can help students build "internal connections" (Mayer, 1984) among important text ideas. Since the text information is more richly connected in the students' heads, it is more available and accessible at the time of testing.

Compared to framing, the recommendations (primarily questions) in the teacher's edition would be less likely to promote selection and organization of important text information. The questions do not necessarily focus on structurally important information, and there are few, if any, instructional suggestions that would help students see the "big picture" of logically connected ideas.

Another possible explanation for the effectiveness of framing, suggested by anecdotal evidence rather than any theory presented in this paper, is that framing may have improved attitudes and motivation toward learning. Framing was something new and different; the novelty of the technique may have boosted students' attention and effort. Support for this explanation comes from comments in Teacher's Logs, for example: "Students showed positive attitudes toward framing," "Active participation and lots of discussion for experimental [Framing] condition," and "Students looked forward to framing and were comfortable with it; liked to study with frames--said frames made sense." In contrast, the Teacher's Edition condition appeared to foster a rather negative attitude toward learning (and even teaching!), perhaps because it was repetitive and boring. Comments in Teacher's Logs about the Teacher's Edition condition included, "Boring way of teaching and kids felt chapter was boring," and "Control [Teacher's Edition] condition very boring for students and teacher."

Another possible explanation might be that more instructional time was spent with the framing conditions than the Teacher's Edition condition. Our data cannot totally rule out this explanation, because, unfortunately, teachers completed or returned lesson time information for only 55% of the "Teacher Logs." However, for this 55%, there are essentially no differences in time spent in Framing vs. Teacher's Edition conditions. For both conditions, the range of mean lesson times was 27 to 60 minutes. The mean time spent on lessons in the Framing conditions was 42 minutes; the mean time for the Teacher's Edition conditions was 40 minutes. Therefore, it seems unlikely that the effectiveness of framing is due to more instructional time. Even if it were, the benefits of framing would seem to outweigh the small cost in time.

Yet another possible explanation for the success of the Framing condition in Rounds 2-4 may be due to the unfortunate confounding of classroom organization and instructional technique necessitated by this "real world" intervention study. That is, it may not be the framing technique itself that was effective, but the cooperative group structure in which the Framing condition was embedded. Indeed, as we mentioned in the rationale for Rounds 2-4, a rather substantial body of research suggests that cooperative settings results in significant improvement in student achievement. Therefore, it is reasonable to expect that the relative success of framing in those rounds where framing was confounded with cooperative learning was at least partially due to the cooperative group structure. However, the cooperative group structure cannot be the sole explanation for the effectiveness of the Framing conditions, for in Round 1, where treatment condition was not confounded with classroom organization, the two Framing conditions were still superior to the Teacher's Edition condition.

Why was the Framing condition more successful for fifth graders than fourth graders in the analysis of all rounds? We offer two possible explanations for this result. The first explanation hinges on differences in the content at the two grades. Fourth-grade social studies focuses on regions. The chapters used in the study include information about landforms (rivers, mountains, deserts, plains) and geographical regions (the Northeast, the Plains States, etc.). The text, primarily descriptive in structure, presents essentially a list of facts. For example,

> Now look at the map on page 76. Find the **Appalachian Mountains**. These are the older mountains. They cover much of our country's eastern side. The Appalachians begin in Newfoundland, Canada, and end in northern Alabama. They stretch almost 2,000 miles (about 3,220 km). (*States and Regions, 1985, p. 77*)

> New Orleans is the largest seaport in the United States. New Orleans lies along the Mississippi River about 100 miles (about 160 km) inland from the Gulf of Mexico. Ships from all over the world bring goods up the Mississippi to New Orleans. They leave with goods shipped into New Orleans from many parts of the United States. (*States and Regions* 1985, pp. 155-156)

To the teachers and researchers, at least, the text seemed to offer few major conceptual understandings or overarching principles. Because it was difficult to find "main ideas" and to decide on an appropriate level of detail to focus on during instruction, we had trouble framing the material. We thought that many of the frames we produced were less than satisfactory. The content for fifth-grade, on the other hand, is United States history. In fifth-grade we found better organized text and more substantive content, which enabled us to create more satisfactory frames. Therefore, differences in the quality of frames, as a reflection of differences in the type and content of text, could account for the greater effectiveness of framing at the fifth-grade level.

A second explanation for the greater effectiveness of framing for the older students may be related to cognitive developmental differences. Although frames are concrete, visual representations, the act of completing a frame requires higher-order, abstract thinking. For example, in filling out a frame, students must be able to make inferences, classify information, draw conclusions, and understand compare-contrast and cause-effect relationships. For this reason, the teachers, especially the fourth-grade teachers, frequently expressed concern that framing was too difficult (although these comments decreased after Round 1, when students began working together in groups using information sheets).

So far we have offered possible explanations for why the Framing conditions may have enhanced learning more than the Teacher's Edition condition. Why, then, was the Teacher's Edition condition sometimes superior? One possible reason has to do with the dependent measures. Recall that, in Rounds 2-4, the teachers assumed major responsibility for making up the tests. Their usual strategy was to start with the publisher's test, selecting items they liked for inclusion on their own tests. The proportion of publisher's questions to teachers' own questions varied from test to test. The publisher's test questions were probably better matched to the instruction in the Teacher's Edition condition than in the Framing conditions. Therefore, for some tests in which teachers chose a relatively larger proportion of publisher's test questions, there may have been a bias in favor of the Teacher's Edition condition.

The research reported here is not without its problems. The biggest problem (which is also one of its strengths, as we shall argue later) is that it is *not* a small-scale, laboratory-type intervention study; rather, it took place in real classrooms with real textbooks and with real teachers doing the instruction over a substantial part of the school year. The main cost of such an ecologically valid study is the loss of control over variables that may have influenced outcomes. The confounding of the framing technique with cooperative learning structures discussed above is one example of this problem. Another example we have already discussed is the lack of control over the source of items on the dependent measures.

Another potential problem inherent in this type of study is that the teachers were not blind to the experimental hypotheses. Therefore, a bias toward the framing technique may have influenced their delivery of instruction. This biasing, in fact, probably did occur, for the teachers were quite vocal in support of framing compared to the teacher's edition.

A third problem is that teachers administered both experimental and control conditions, so that there may have been a carry-over effect from treatment to treatment. It is rather unlikely that this effect occurred, for the teachers were made well aware, throughout the year, of the importance of conforming to the treatment conditions. We also had the "Teacher Logs," which documented their faithfulness to the treatments. If carry-over had occurred, however, it probably would have been carryover from the Framing to the Teacher's Edition condition, because the teachers clearly favored the Framing condition. Carry-over from the Framing to the Teacher's Edition condition would probably have elevated the scores of students in the Teacher's Edition condition, which would have provided an even more stringent test of our hypothesis.

The fact that this research *is* ecologically valid, however, is also one of its strengths. The results of this research are perhaps more credible than the results of many intervention studies. The study involved

a larger than usual number of teachers, students, and texts over a longer than usual intervention period. In addition, the research involved four replications over the course of an entire school year. Therefore, the design of this study allowed for an experimental test to occur in the context of influences and factors that would naturally occur in classroom learning situations.

It is worth noting that the Framing Project exemplifies a fruitful collaboration between a research unit of a university and public schools. In the Framing Project, both sides are beneficiaries of the collaboration. The teachers are inserviced about recent theory and research in reading; they also benefit from continuing instructional, administrative, and collegial support. The university research unit benefits by having access to a rather large research site in which to conduct ecologically valid applied research. The university researchers also have the advantage of the "reality test" of the real world of practicing teachers.

## References

Anderson, R. C., & Pearson, P. D. (1984). A schema theoretic view of basic processes in reading comprehension. In P. D. Pearson (Ed.) *Handbook of reading research* (pp. 255-291). New York: Longman.

Applebee, A. N., Langer, J. A., & Mullis, I. V. S. (1989) *Crossroads in American education*. Princeton, NJ: Educational Testing Service.

Armbruster, B. B., & Anderson, T. H. (1984a). Mapping: Representing informative text diagrammatically. In C. D. Holley & D. F. Dansereau (Eds.), *Spatial learning strategies: Techniques, applications, and related issues* (pp. 189-209). New York: Academic Press.

Armbruster, B. B., & Anderson, T. H. (1984b). Structures for explanations in history textbooks, or so what if Governor Stanford missed the spike and hit the rail? *Journal of Curriculum Studies, 16*, 181-194.

Armbruster, B. B., & Anderson, T. H. (1985). Frames: Structures for informative text. In D. H. Jonassen (Ed.), *The technology of text* (Vol. 2, pp. 90-104). Englewood Cliffs, NJ: Educational Technology Publications.

Armbruster, B. B., Anderson, T. H., & Ostertag, J. (1987). Does text structure/summarization instruction facilitate learning from expository text? *Reading Research Quarterly, 22*, 331-346.

Armbruster, B. B., Anderson, T. H., & Ostertag, J. (1989). Teaching text structure to improve reading and writing. *Reading Teacher, 43*, 130-137.

Berkowitz, S. J. (1986). Effects of instruction in text organization on sixth-grade students' memory for expository reading. *Reading Research Quarterly, 21*, 161-178.

Boothby, P. R., & Alvermann, D. E. (1984). A classroom training study: The effects of graphic organizer instruction on fourth graders' comprehension. *Reading World, 23*, 325-339.

Brown, A. L., & Day, J. D. (1983). Macrorules for summarizing texts: The development of expertise. *Journal of Verbal Learning and Verbal Behavior, 22*, 1-14.

Cohen, J., & Cohen. P. (1983). *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*. Hillsdale, NJ: Erlbaum.

Holley, C. D., & Dansereau, D. F. (Eds.) (1984). *Spatial learning strategies: Techniques, applications, and related issues*. New York: Academic Press.

Johnson, D. W., & Johnson, R. T. (1974). Instructional goal structure: Cooperative, competitive, or individualistic. *Review of Educational Research, 44*, 213-240.

Johnson, D. W., Maruyama, G., Johnson, R., Nelson, D., & Skon, L. (1981). The effects of cooperative, competitive, and individualistic goal structures on achievement: A meta-analysis. *Psychological Bulletin, 89*, 47-62.

Mayer, R. E. (1984). Aids to text comprehension. *Educational Psychologist, 19*, 30-42.

Mayer, R. E. (1989). Models for understanding, *Review of Educational Research, 59*, 43-64.

McGee, L. M. (1982). Awareness of text structure: Effects on children's recall of expository text. *Reading Research Quarterly, 17*, 581-590.

Meyer, B. J. F., Brandt, D. M., & Bluth, G. J. (1980). Use of top-level structure in text: Key for reading comprehension of ninth-grade students *Reading Research Quarterly, 16*, 72-103.

Pedhazur, E. J. (1982). *Multiple Regression in Behavioral Research*. New York: Holt, Rinehart & Winston.

Prawat, R. S. (1989). Promoting access to knowledge, strategy, and disposition in students: A research synthesis. *Review of Educational Research, 59*, 1-42.

Rumelhart, D. E., & Ortony, A. (1977). The representation of knowledge in memory, In R. C. Anderson, R. J. Spiro, & W. E. Montague (Eds.), *Schooling and the acquisition of knowledge* (pp. 99-136). Hillsdale, NJ: Erlbaum.

Slaven, R. E. (1983). *Cooperative learning*. New York: Longman.

Slavin, R. E. (1980). Cooperative learning. *Review of Educational Research, 50*, 315-342.

*States and regions* (1985). Orlando, FL: Harcourt Brace Jovanovich.

Taylor, B. M. (1980). Children's memory for expository text after reading. *Reading Research Quarterly, 15*, 399-411.

Taylor, B. M. (1985). Toward an understanding of factors contributing to children's difficulty summarizing textbook material. In J. A. Niles (Ed.), *Issues in literacy: A research perspective. Thirty-fourth yearbook of the National Reading Conference* (pp. 125-131). Rochester, NY: National Reading Conference.

Taylor, K. K. (1986). Summary writing by young children. *Reading Research Quarterly, 21*, 193-208.

Tyson-Bernstein, H. (1988). *A conspiracy of good intentions*. Washington, DC: The Council for Basic Education.

*The United States: Its history and neighbors* (1985). Orlando, FL: Harcourt Brace Jovanovich.

van Dijk, T. A., & Kintsch, W. (1983). *Strategies of discourse comprehension*. New York: Academic Press.

Wilkinson, L. (1987). *SYSTAT: The System for Statistics*. Evanston, IL: SYSTAT, Inc.

Winograd, P. N. (1984). Strategic difficulties in summarizing texts. *Reading Research Quarterly, 19*, 404-425.

**Table 1**

**Round 1 Texts: Titles and Approximate Number of Words**

| Grade | Text No. | Chapter or Section Title | Approx. Number of Words |
|---|---|---|---|
| 4 | 1 | "Rivers" | 1,945 |
| 4 | 2 | "Mountains" | 2,025 |
| 4 | 3 | "Deserts" | 1,420 |
| 5 | 1 | "Colonists Succeed at Jamestown" | 830 |
| 5 | 2 | "The Growth of Virginia" | 700 |
| 5 | 3 | "Using Physical Maps" | 895 |

**Table 2**

**Experimental Design for Round 1**

| Teacher (at each grade) | Condition | | |
|---|---|---|---|
| | 1 = Student Framing | 2 = Teacher-led Framing | 3 = Teacher's Edition |
| | No. of Assigned Text* | No. of Assigned Text | No. of Assigned Text |
| 1 | 1 | 2 | 3 |
| 2 | 2 | 3 | 1 |
| 3 | 3 | 1 | 2 |
| 4 | 1 | 2 | 3 |
| 5 | 2 | 3 | 1 |
| 6 | 3 | 1 | 2 |

* "No. of Assigned Text" refers to "Text No." from Table 1.

**Table 3**

**Rounds 2-4 Texts: Titles and Approximate Number of Words**

| Grade | Round | Chapter Title | Approx. No. of Words |
|---|---|---|---|
| 4 | 2 | "The Great Lakes States" | 3,290 |
| 4 | 2 | "The Plains States" | 2,910 |
| 4 | 3 | "The Southwest" | 2,870 |
| 4 | 3 | "The Mountain States" | 2,890 |
| 4 | 4 | "The Pacific States" (Part 1) | 1,565 |
| 4 | 4 | "The Pacific States" (Part 2) | 2,225 |
| 5 | 2 | "Background of the Revolution" (Part 1) | 1,515 |
| 5 | 2 | "Background of the Revolution" (Part 2) | 2,135 |
| 5 | 3 | "The Nation Grows" (Part 1) | 1,705 |
| 5 | 3 | "The Nation Grows" (Part 2) | 1,985 |
| 5 | 4 | "Background of the Conflict" (Part 1) | 1,295 |
| 5 | 4 | "Background of the Conflict" (Part 2) | 1,930 |

**Table 4**

**A Comparison of Treatment Conditions for Fifth-Grade Teachers in Round 1**

| | Student Framing | | | Teacher-Led Framing | | | Teacher's Editions | | |
|---|---|---|---|---|---|---|---|---|---|
| Teachers | *M* | *SD* | *N* | *M* | *SD* | *N* | *M* | *SD* | *N* |
| 1 | 47.7 | 25.4 | 21 | 68.6 | 31.3 | 21 | 31.5 | 21.9 | 20 |
| 2 | 58.4 | 23.2 | 25 | 68.6 | 29.4 | 25 | 42.9 | 21.3 | 25 |
| 3 | 76.8 | 20.7 | 18 | 49.5 | 22.7 | 19 | 43.0 | 23.6 | 18 |
| 4 | 59.1 | 22.5 | 54 | 44.9 | 17.6 | 46 | 38.0 | 16.9 | 46 |
| 5 | 37.8 | 17.7 | 30 | 37.9 | 21.6 | 29 | 55.6 | 23.4 | 30 |
| 6 | 33.7 | 19.1 | 20 | 37.3 | 28.8 | 18 | 49.0 | 22.4 | 17 |

**Table 5**

**Means and Standard Deviations for Fourth- and Fifth-Grade Teachers Across all Rounds**

| | Fourth Grade | | | Fifth Grade | | |
|---|---|---|---|---|---|---|
| Teachers | *M* | *SD* | *N* | *M* | *SD* | *N* |
| 1 | 67.6 | 20.7 | 208 | 46.9 | 26.0 | 192 |
| 2 | 50.4 | 19.5 | 137 | 61.6 | 25.1 | 233 |
| 3 | 66.9 | 19.9 | 397 | 63.4 | 22.7 | 179 |
| 4 | 59.7 | 20.7 | 153 | 44.8 | 20.2 | 443 |
| 5 | 60.9 | 20.4 | 240 | 42.5 | 21.0 | 301 |
| 6 | 60.9 | 21.4 | 199 | 47.3 | 24.9 | 171 |

**Table 6**

**A Comparison of Treatment Conditions for Fifth-Grade Teachers on All Rounds**

| | Teacher's Edition | | | Framing | | |
|---|---|---|---|---|---|---|
| Teacher | *M* | *SD* | *N* | *M* | *SD* | *N* |
| 1 | 42.2 | 23.7 | 86 | 50.8 | 27.2 | 108 |
| 2 | 54.3 | 21.9 | 104 | 67.5 | 26.0 | 129 |
| 3 | 62.7 | 24.5 | 80 | 64.1 | 21.3 | 99 |
| 4 | 44.3 | 19.1 | 193 | 45.2 | 21.1 | 249 |
| 5 | 39.7 | 20.7 | 136 | 44.7 | 21.1 | 165 |
| 6 | 44.9 | 21.3 | 75 | 49.2 | 27.3 | 96 |

**Table 7**

**A Comparison of Fourth-Grade Teachers by Rounds and Treatment Condition**

| | Round 1 | | | | | | Round 2 | | | | | | Round 3 | | | | | | Round 4 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Teacher's Edition | | | Framing | | | Teacher's Edition | | | Framing | | | Teacher's Edition | | | Framing | | | Teacher's Edition | | | Framing | | |
| Teacher | *M* | *SD* | *N* | *M* | *SD* | *N* | *M* | *SD* | *N* | *M* | *SD* | *N* | *M* | *SD* | *N* | *M* | *SD* | *N* | *M* | *SD* | *N* | *M* | *SD* | *N* |
| 1 | 66.4 | 19.3 | 22 | 74.1 | 19.0 | 43 | 71.3 | 19.1 | 26 | 68.7 | 18.0 | 25 | 64.9 | 16.3 | 25 | 75.0 | 21.8 | 25 | 58.0 | 22.3 | 21 | 54.1 | 24.3 | 21 |
| 2 | 51.4 | 16.4 | 13 | 52.3 | 20.0 | 26 | 54.5 | 20.8 | 15 | 60.5 | 10.9 | 17 | 59.3 | 22.1 | 17 | 43.5 | 14.4 | 17 | 35.1 | 20.1 | 16 | 44.9 | 18.6 | 16 |
| 3 | 60.1 | 22.2 | 41 | 65.0 | 18.4 | 87 | 65.0 | 16.7 | 43 | 71.5 | 17.8 | 47 | 86.0 | 17.3 | 43 | 65.8 | 13.0 | 47 | 62.5 | 20.2 | 45 | 61.4 | 22.8 | 45 |
| 4 | 44.7 | 25.1 | 15 | 61.8 | 19.0 | 34 | 64.6 | 18.8 | 16 | 67.9 | 18.3 | 17 | 49.8 | 11.9 | 16 | 65.4 | 20.4 | 19 | 72.8 | 15.1 | 18 | 45.5 | 19.7 | 18 |
| 5 | 69.0 | 20.2 | 24 | 65.1 | 22.1 | 50 | 54.0 | 19.2 | 27 | 64.6 | 15.8 | 28 | 71.3 | 21.6 | 28 | 58.8 | 18.8 | 27 | 50.7 | 17.4 | 28 | 51.7 | 16.8 | 28 |
| 6 | 66.0 | 17.7 | 22 | 56.3 | 22.1 | 40 | 74.0 | 16.8 | 21 | 67.5 | 17.4 | 24 | 58.6 | 16.8 | 22 | 69.5 | 24.6 | 23 | 48.1 | 17.2 | 24 | 52.5 | 24.0 | 23 |

**Table 8**

**A Comparison of Fifth-Grade Teachers by Rounds and Treatment Conditions**

| | Round 1 | | | | | | Round 2 | | | | | | Round 3 | | | | | | Round 4 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Teacher's Edition | | | Framing | | | Teacher's Edition | | | Framing | | | Teacher's Edition | | | Framing | | | Teacher's Edition | | | Framing | | |
| Teacher | *M* | *SD* | *N* | *M* | *SD* | *N* | *M* | *SD* | *N* | *M* | *SD* | *N* | *M* | *SD* | *N* | *M* | *SD* | *N* | *M* | *SD* | *N* | *M* | *SD* | *N* |
| 1 | 31.5 | 21.9 | 20 | 58.2 | 30.1 | 42 | 32.5 | 13.9 | 21 | 44.1 | 21.7 | 21 | 46.0 | 26.0 | 23 | 54.1 | 29.0 | 23 | 57.0 | 22.4 | 22 | 38.3 | 17.4 | 22 |
| 2 | 42.9 | 21.3 | 25 | 63.5 | 26.7 | 50 | 55.6 | 17.2 | 27 | 65.2 | 23.8 | 27 | 56.1 | 22.7 | 27 | 67.2 | 28.6 | 27 | 62.4 | 22.6 | 25 | 78.3 | 22.0 | 25 |
| 3 | 43.0 | 23.6 | 18 | 62.8 | 25.5 | 37 | 56.7 | 22.0 | 19 | 58.4 | 17.1 | 19 | 68.0 | 21.1 | 22 | 70.5 | 21.0 | 22 | 79.3 | 17.3 | 21 | 64.7 | 15.4 | 21 |
| 4 | 38.0 | 16.9 | 46 | 52.5 | 21.5 | 100 | 40.5 | 18.0 | 53 | 39.8 | 14.8 | 53 | 41.5 | 16.9 | 55 | 32.1 | 20.0 | 56 | 61.1 | 17.1 | 39 | 52.3 | 17.8 | 40 |
| 5 | 55.6 | 23.4 | 30 | 37.8 | 19.5 | 59 | 34.1 | 15.6 | 42 | 43.3 | 21.3 | 42 | 38.7 | 18.6 | 34 | 44.4 | 19.7 | 34 | 32.6 | 18.9 | 30 | 60.7 | 17.3 | 30 |
| 6 | 49.0 | 22.4 | 17 | 35.4 | 23.9 | 38 | 38.5 | 18.3 | 21 | 42.4 | 17.7 | 21 | 35.0 | 20.1 | 20 | 57.4 | 26.6 | 20 | 60.4 | 14.8 | 17 | 79.1 | 22.4 | 17 |

**Figure 1**

**Example of Fourth-Grade Frame from Round 1**

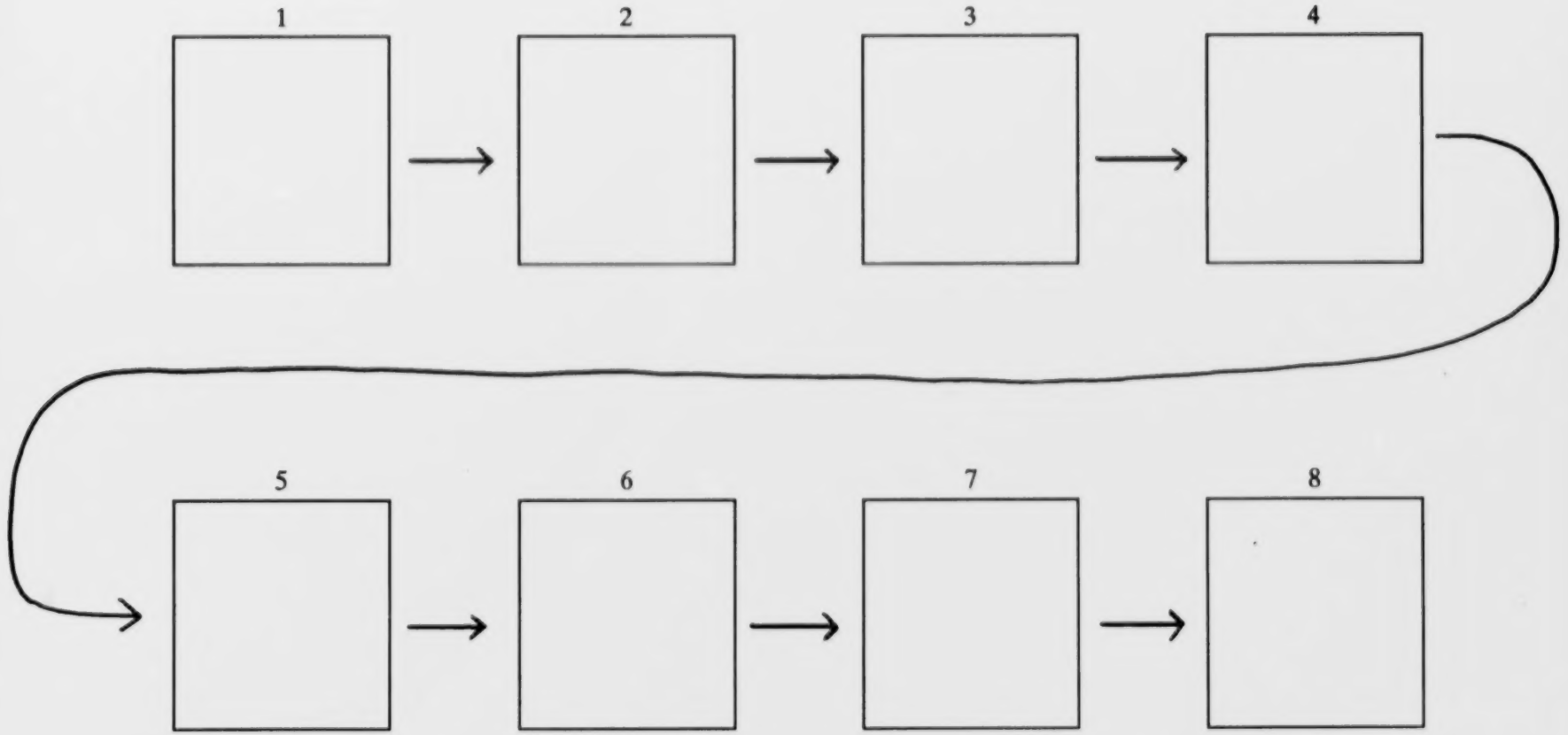

**Figure 2**

**Example of Fifth-Grade Frame from Round 1**

**Using Physical Maps**

| Type of Map | Use | How to read | Examples (pages where maps appear) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

Name _____ Teacher _____

# 4. The Battle of Gettysburg

(Chapter 16, pp 370-372)

## GOAL:

The victory at Chancellorsville gave the Confederacy confidence to try to invade the North. The Confederate goal was to end the war by winning a clear victory on Northern soil.

## ACTIONS:

The Battle of Gettysburg

The high point was Pickett's Charge, a moving wall of Confederate soldiers led by General George Pickett. The charge failed and the Confederate troops retreated.

## RESULTS:

Casualties were high because of the advance in war technology, including new kinds of cannons and guns called musket rifles.

Lincoln gave a famous speech called The Gettysburg Address.

The North was now fighting for 3 goals:
1. preservation of the Union
2. freedom for slaves
3. defense of democracy

Figure 3. Example of completed fifth grade frame from Rounds 2-4.

**Figure 4**

**Information Sheet for a Fourth-Grade Frame**

**Information Sheet for "The Plains States - 1"**

| | |
|---|---|
| Two landforms in the Plains states are the _____ and the _____. | The four states in the Great Plains are _____, _____, _____, and _____. |
| Most of the land in the Plains states is not perfectly flat, but is _____. | People of the Plains states also use groundwater, which is _____. |
| Pumps, sometimes driven by _____, bring groundwater to the surface. The water is used by _____ and _____. | The two states in the Central Plains are _____ and _____. |
| The Plains states are in the Interior Plains, which are divided into the _____ and the _____. | |
| Two of the largest rivers are the _____ and the _____. | |